1.0 INTRODUCTION

The Ramona Grasslands are located in the Santa Maria Valley, west of the town of Ramona in San Diego County (Figure 1). In 2003 the State Water Resources Control Board awarded a Proposition 13 grant to the County of San Diego for the protection and restoration of a portion of Santa Maria Creek and adjacent ephemeral aquatic habitats in the Ramona Grasslands Preserve (Preserve). The Preserve is comprised of a number of properties that have already been conserved or are publicly owned, properties with conservation agreements pending, and properties targeted for conservation (Figure 2). Additional land is anticipated to be included in the Preserve via landowner dedications as mitigation for future development projects (e.g., portions of Cumming Ranch). (Figure 2). The Preserve supports many of the unique biological resource values represented in the greater Preserve, provides a suite of important environmental services for the region, and embodies a rich cultural and historic heritage.

The Preserve hosts a unique assemblage of resources:

- The southernmost population of the federally endangered Stephens' kangaroo rat (*Dipodomys stephensi*);
- Unique vernal wetlands that support federally endangered San Diego fairy shrimp (*Branchinecta sandiegonensis*) and several rare plant species;
- An important population of the federally endangered arroyo toad (*Bufo californicus*) in Santa Maria Creek; and
- A diverse raptor community, including the largest population of wintering ferruginous hawks (*Buteo regalis*) in San Diego.

As part of the Proposition 13 grant project, a variety of field surveys and monitoring was implemented to characterize baseline conditions of the Preserve to inform future management and monitoring efforts. This Baseline Conditions Report summarizes the results of these surveys and monitoring efforts. Management and monitoring prescriptions are discussed in the Ramona Grasslands Preserve Area Specific Management Directives (CBI 2007).

2.0 STUDY AREA DESCRIPTION

The Ramona Grasslands are located in the Santa Maria Valley, situated between the coastal mesas and the mountains of the Peninsular Ranges in west-central San Diego County (Figure 1). The Santa Maria Valley is a broad basin (elevation 1,350-1,450 ft), surrounded by gentle hills and rocky rises vegetated with coastal sage scrub, chaparral, and oak woodlands. It lies within the Southern California Mountains and Valleys ecological section of the South Coast Ecoregion (Bailey et al. 1994, Goudey and Smith 1994, McNab and Avers 1994; Miles and Goudey 1998). The Preserve (Figure 2) is currently 1,950 acres in size; comprised of Davis-Eagle Ranch (1,230 acres), Cagney Ranch (420 acres), The Nature Conservancy (TNC) Oak Country Estates (230 acres), and Hardy Ranch (70 acres).

The core grasslands area of the Preserve remains relatively unfragmented, except by a few paved roads (e.g., Rangeland Road) and unpaved ranching roads (Figure 2). The Santa Maria Valley itself is bordered by rural residential development and estate homes scattered on the hills surrounding the valley. South of the Preserve, houses line the south side of a portion of Santa Maria Creek along Voorhes Lane. Some areas around the periphery of the Preserve are used for dry farming and citrus and avocado orchards. Undeveloped land is located northwest, west, and east of the conserved lands. Northwest of the 1,950 acres of conserved lands is the 1,350-acre Gildred Family Ranch, which is currently under a purchase option with TNC. Adjacent to the conserved portion of Oak Country Estates (TNC Oak Country Estates) is the portion of Oak Country Estates, which has an approved residential development plan, and the Martz property, which is zoned as open space. East of the Cagney Ranch is Cumming Ranch, which currently has a proposed residential development plan, but a portion of which will likely be conserved as project mitigation or surplus open space land to be donated and/or sold to County of San Diego Department of Parks and Recreation (DPR). Northeast of Davis-Eagle Ranch is the proposed Montecito Ranch residential development (Figure 2). Offsite improvements, including the proposed Montecito Road, would accompany this development project. The proposed Montecito Road alignment extends south from Montecito Ranch, through the eastern portion of Davis-Eagle Ranch, and across Cumming Ranch.

2.1 Onsite Land Uses

2.1.1 Ramona Airport

The Ramona Airport lies at the eastern end of the Preserve, between Cagney Ranch and Davis-Eagle Ranch. The California Department of Forestry and Fire Protection has maintained the Ramona Air Attack Base at the airport since 1958. In 2002 the County extended the 4,000-foot runway an additional 1,000 feet to the west to accommodate larger fire-fighting aircraft. This extension, along with associated airport upgrades (e.g., sewer lines, taxiway, control tower), removed habitat occupied by the endangered Stephens' kangaroo rat (SKR), adversely affected vernal pools, and filled U.S. Army Corps of Engineers and California Department of Fish and Game jurisdictional wetlands and waters. As mitigation for these impacts, 62.5 acres of airport property were conserved (west and north of the extended runway in the western half of the airport property), 20.2 acres supporting vernal pools were conserved as part of the Preserve, and 0.23 acres of wetlands were created and 0.51 acres enhanced in the southwestern corner of Cagney Ranch within the Preserve. Habitat management plans for SKR (FAA 2002) and vernal pools (FAA 2003) were prepared to govern long-term management and monitoring of these target resources on the mitigation sites. Management of resources on the airport property will be performed by DPW, while long-term management of the resources in the Preserve (i.e., vernal pool and wetland mitigation sites, Figure 2) will be performed by DPR.

2.1.2 Ramona Municipal Water District

The Ramona Municipal Water District (RWMD) utilizes a portion of the Ramona Grasslands for storage and infiltration of treated sewage effluent. Treated effluent is piped from a treatment facility at the eastern end of the Ramona Grasslands to two storage reservoirs at the western end of the valley. Treated effluent is disposed via infiltration within a series of spray fields on the northwestern portion of Davis-Eagle Ranch. The irrigated spray fields are an important year-round source of green forage for cattle grazing of Cagney Ranch, Oak Country Estates, and

Davis-Eagle Ranch. Discussions are currently underway to determine if RMWD will acquire a portion of Davis-Eagle Ranch used for the spray fields or will enter into a long-term leases agreement with TNC for their use of the spray fields.

2.1.3 Cattle grazing

The majority of the core grasslands area has been used for cattle grazing for many years, with limited improvements such as perimeter fencing and wells installed over the years. Part of the Preserve (i.e., Cagney Ranch, TNC Oak Country Estates, and Davis-Eagle Ranch) is currently under lease to Tellam and Tellam Cattle for cattle ranching, while Hardy Ranch (and Cumming Ranch) is currently leased for grazing by Jack Dempsey. The Tellam and Tellam Cattle operation is the largest in the Preserve compared to Jack Dempsey, and consists of year-round cattle grazing, without formalized rotation or rest periods. Stocking rates are established on an annual basis, primarily based on weather and forage conditions (Tellam personal communication). No quantitative measures are made of forage production or residual dry matter. Bulls are added to the range around the first week of December to begin siring calves, with calving starting in mid-September of the following year. Calves are removed the following summer when the forage begins losing nutritional value. Supplemental feed is provided during summer (molasses supplement for increased protein and improved digestion of the dry forage), when the pregnant cows are on the range, which is otherwise low in nutrition once the vegetation dries out.

Grazing intensity, expressed as Animal Units per Month (AUMs) for the Cagney Ranch, Oak Country Estates, and Davis-Eagle Ranch is summarized in Table 2. DPR staff have estimated approximately 20 cows are currently grazing the Cumming and Hardy Ranch as a unit (McFedries personal communication). The lease agreement with Jack Dempsey allows a maximum of 70 cows to graze on Hardy Ranch.

2.2 Geology and Soils

The Santa Maria Valley basin is predominantly filled with soils of the Fallbrook and Bonsall series (Figure 3), which are well-drained to moderately well-drained sandy loams with a subsoil of clay loam or sandy clay loam over decomposed granodiorite, on gentle (2-9%) slopes (USDA 1973). On a more local scale, however, there is significant variation in soil characteristics depending on topographic location, depth of clay subsoils, and effects of erosion and deposition. Granodiorite outcrops dot the grasslands, predominantly on hilltops, with relatively deep, well-drained soils of decomposed granodiorites (in the Vista or Fallbrook series) sloping away from them. Lower-lying areas tend to support heavier clay soils, with shallow or even surface expression of clay hardpans. These soils sometimes develop characteristic vernal pool mima mound topography, which is best expressed on the Placentia soils in the Preserve near the southeast corner of the Ramona Airport. Gabbro outcrops and associated Las Posas soils are scattered through the grasslands likely influence plant associations (Sproul personal communication). Soils within the floodplain of Santa Maria Creek include deep, well-drained to excessively drained, sandy alluvium in the Visalia series (USDA 1973).

Soils have a strong influence on the distribution of target resources and management emphasis. Placentia soils have the greatest concentration of vernal pools. Bosanko clays dominate the low-lying eastern portion of the core grasslands and are present in patches on the western portion of the Preserve, and support existing native grasslands. Several sandy loams (e.g., Fallbrook and Vista) in the northern and western portion of the grasslands provide optimal habitat conditions for SKR. Soils along Santa Maria Creek are mostly sandy alluvial deposits—Tujunga sands along the stream channel and Visalia sandy loams in the adjacent floodplain. A series of alkali playas lies within areas mapped as Visalia sandy loams (USDA 1973), but these areas more likely have clay soil inclusions or eroded areas too small to have been mapped at the USDA mapping resolution.

Table 1. Grazing intensity (AUM) on Cagney Ranch, Oak Country Estates and Davis-Eagle Ranch from 2004-2005.

Month	**2004**[1]	**2005**[2]	**2006**[3]
January	—	10/6	40/8/115
February	—	18/6	30/10/115
March	—	18/6	40/10/115
April	—	18/6	40/10/115
May	—	18/6	8/115[4]
June	—	18/6	30/8/115
July	—	18/6	8/105[5]
August	—	18/6	0/105 (135)[6]
September	20	18/6	—
October	20	18/6	—
November	20	18/6	—
December	20	18/6	—

— = No data
[1] AUM on Cagney Ranch
[2] AUM on Cagney Ranch/TNC Oak Country Estates
[3] AUM on Cagney Ranch/TNC Oak Country Estates/Davis-Eagle Ranch
[4] AUM on TNC Oak Country Estates/Cagney Ranch + Davis-Eagle Ranch, with 40 AUMs moved to the Vangler property this month.
[5] AUM on TNC Oak Country Estates/Cagney Ranch + Davis-Eagle Ranch
[6] AUM on TNC Oak Country Estates/Cagney Ranch + Davis-Eagle Ranch from 8/1 -8/28. Cagney Ranch + Davis-Eagle Ranch had 135 AUM from 8/28 – 8/31. No cows were on TNC Oak Country Estates during the month because of a mistakenly closed gate.

2.3 Climate

Temperature extremes at Ramona range from about 17^{o}F to 112^{o}F, with minimum mean temperatures in December-January of 37-38^{o}F, and maximum mean temperatures during July-August of approximately 91^{o}F (as recorded at the Ramona Airport). In the summer months the climate is generally hot and subhumid, with moderate oceanic influence. For the purposes of this report, rainfall data are summarized on a water year basis (October 1 – September 30), which is a common annual interval used by hydrologists in the U.S. to ensure annual stream flow and precipitation patterns are not split between calendar years. Rainfall is largely restricted to the period November through March, with 65% of the average annual rainfall of 15.86 inches/year falling from January to March. Inter-annual variation in rainfall can be high. For example, during water years from 1974 to 2005, annual totals ranged from a minimum of 3.17 inches in 2001/2002 to a maximum of 34.08 inches in 1977/1978 (Western Regional Climate Center 2006). Rainfall totals for years 2002/2003, 2003/2004, and 2004/2005 were 17.38 inches, 7.64 inches, and 27.24 inches, respectively. Rainfall from October 1, 2005 through July 2006 is 7.94 inches (with reported March data incomplete).

2.4 Hydrology

The Ramona Grasslands comprise a significant portion of the Santa Maria Creek subbasin of the San Dieguito River watershed (Figure 4a). Santa Maria Creek and its tributaries drain about 57 mi^2 from the mountains east of Ramona, across the Ramona Grasslands, and through the steep and narrow walls of Bandy Canyon to its confluence with Santa Ysabel Creek. Below the confluence, the San Dieguito River flows through San Pasqual Valley into Lake Hodges, a City of San Diego drinking water reservoir listed as an impaired water body (Clean Water Act 303(d) listed) due to excessive nutrients and color from runoff of non-point source pollutants within the watershed.

Santa Maria Creek generally exhibits ephemeral flow in response to winter rainfall; although surface flow in the creek may persist very late in the year in heavy rainfall years and surface water is perennial at the far western end of the valley. The U.S. Geological Survey (USGS) has operated a stream gauge at the western end of the Santa Maria Valley (HUC 11028500), which measures all flow leaving the Ramona Grasslands. Annual mean daily streamflow of Santa Maria Creek from 1974-2005 was 3,968 cubic feet per second (cfs), and ranged from almost no flow for some years to 28,547 cfs in 1993. The Ramona Grasslands drain to Santa Maria Creek via ephemerally flowing swale features. During the extremely rainy 2004/2005, surface water left the Santa Maria Creek channel near the western boundary of Hardy Ranch (peak flow 2,050 cubic feet per second). Surface water flowed through an east-west trending swale across the grasslands, where it crossed Rangeland Road and then re-entered Santa Maria Creek via a tributary swale (Figure 4b). This east-west trending swale supports the alkali playa system.

3.0 METHODS

Resource-specific quantitative surveys were conducted in 2005 and 2006 for the Preserve and are described in the sections below. In addition, qualitative botanical surveys were conducted in 2005 and 2006. These surveys focused on mapping occurrences of sensitive plant species encountered in the Preserve as other field activities were conducted. The results of these qualitative surveys are presented in Section 4.

3.1 Grasslands

Surveys were conducted in the grassland habitats of the Preserve to map habitat quality for Stephens' kangaroo rat, assess vegetation composition and structure, and use of the preserve by raptors for wintering and breeding.

3.1.1 Stephens' kangaroo rat

Detailed SKR survey methodologies can be found in *Biological Survey Report for the Santa Maria Creek Restoration Project: Stephens' kangaroo rat* (Spencer and Montgomery 2007, Appendix A), and are summarized below.

A primary aim of this study was to create a comprehensive SKR distribution map for the Preserve to inform future management and monitoring actions. This was accomplished by surveying all properties within the Preserve and supplementing these surveys with existing information from properties adjacent to the Preserve, most notably the Ramona Airport. Some adjacent properties are also known from previous surveys not to support SKR or suitable habitat (e.g., Cumming Ranch; O'Farrell 2000a, 2004). SKR absence was inferred for some properties for which access was not granted (e.g., Hobbs and the "Voorhes Lane properties") based on lack of suitable habitat, as indicated by inspection of aerial photographs and ground-truthing from property boundaries. However, no attempt was made to map SKR distribution on some properties that are known to support SKR based on previous trapping surveys (P. Vergne, unpublished data), but that could not be confidently map without access (e.g., Martz and RWMD ownerships).

On properties within the Preserve, distribution and relative abundance of SKR were mapped in the field by Wayne Spencer and Stephen Montgomery, with assistance from Esther Rubin and Scott Tremor (Table 1). During 2005, surveys covered properties included in the Preserve at that time (Cagney, Hardy, and TNC Oak Country Estates). Davis-Eagle Ranch was added to the reserve area in December 2005 and surveyed for SKR during 2006. During 2006 a number of areas previously surveyed during 2005 were spot-checked to confirm that SKR distribution had not changed notably from one year to the next, so the composite 2005-2006 map could be treated as one consistent baseline data source.

Table 2. SKR distribution survey dates and areas surveyed.

Date	Observers*	Area Surveyed
2005		
23-Sep	WS, SJM	North and west TNC Oak Country Estates
12-Nov	WS, SJM	East end Cagney, Hardy
19-Nov	WS SJM	Central Cagney
17-Dec	WS, ST	South Cagney, south and central TNC Oak Country Estates
2006		
25-Aug	WS	Southwest Eagle Ranch and spot checks on Cagney
5-Sep	WS, SJM, ER	Central and north Davis-Eagle Ranch and spot checks on TNC Oak Country Estates
6-Sep	WS, SJM, ER	North and northeast Davis-Eagle Ranch
8-Sep	WS, SJM, ER	South and central Davis-Eagle Ranch and spot checks
26-Oct	WS	West-central Davis-Eagle Ranch and spot checks on airport, Cagney
26-Oct	WS	Northwest Davis-Eagle Ranch and spot checks on Cagney

* WS = Wayne Spencer, SJM = Stephen Montgomery, ST = Scott Tremor and ER = Esther Rubin

The mapping method involved walking meandering transects over the entire area (at no greater than 50-m spacing) searching for signs of SKR occupancy (burrows, scats, tracks, dust baths). Once signs of occupancy were found in a particular location, the biologists searched for the outer perimeter of the occupied area (where no further sign could be found, or where habitat clearly became unsuitable), enclosed it with a polygon, and classified the relative density of SKR burrows within the polygon using density classes originally developed by Michael O'Farrell (1992) and modified by Stephen Montgomery for ease in mapping at finer resolution (Table 3). Results were marked onto 1:3200-scale, true-color aerial photographs. Mapping was aided by having the aerials gridded with 50 x 50-m cells and by use of GPS. During 2005 and 2006 surveys of the Preserve, most occupied habitat supported only trace SKR densities; moderate-density areas were very rare, and there were no high density areas to map.

Table 3. SKR burrow density classes as originally defined by O'Farrell (1992) and as scaled down for finer-resolution mapping in the field by S. Montgomery.

Density Class	**Burrows/ha (O'Farrell)**	**Burrows/200 m^2 (Montgomery)**
Trace	<50	<1
Low	50-200	1-4
Moderate	200-700	4-14
High	>700	>14

SKR density was also mapped at the edges of the Ramona Airport, and incorporated an edge-matched distribution and density mapping performed on the Airport property in 2005 by Haas and O'Farrell (2005). The Haas and O'Farrell (2005) polygons were converted to a similar mapping resolution as the current data and applied the same density classes as were done on Preserve. The polygons near the Airport boundary were calibrated and adjusted as necessary based on the current observations. In addition to survey dates listed in Table 2, which all reflect ideal sign-survey conditions during late summer-fall, Wayne Spencer also spot-checked portions of the study area during winter-spring conditions on January 26 and April 28, 2006.

Limited trapping surveys were performed in portions of the Preserve to confirm which species of kangaroo rat was present, SKR or the non-listed Dulzura kangaroo rat (*Dipodomys simulans;* DKR; formerly *D. agilis*). Although these two species sometimes co-occur at a local scale, SKR are competitively dominant and almost always occupy the most open grassland habitats, whereas DKR are generally restricted to those areas with some scrub cover (Price et al. 1991). Previous intensive trapping surveys in the Ramona Grasslands (e.g., Ogden 1998, Spencer 2002, P. Vergne unpublished data) have repeatedly reinforced these observations, with only SKR found in the open grasslands but either species occurring grass/scrub interface areas and predominantly DKR in open scrub habitats or oak savannahs. Consequently, sample-trapping was conducted to identify which of the two species was present in scrub interface areas and refine the mapping of SKR-occupied habitat areas.

3.1.2 Grassland vegetation

Field surveys

Quantitative vegetation surveys of the Preserve were conducted in 2005 and 2006, and included determination of species composition, vegetative cover (including amount of bare ground and thatch), plant height, and biomass. Plot locations varied over the two year period as additional properties were added to the Preserve. Plot numbers and survey year are summarized in Table 4 and shown in Figure 5. All field surveys were conducted by DPR staff Fred Sproul and Gena Calcarone.

Grassland surveys were conducted from May to July each year using a point-intercept methodology. In 2005, two 50-meter transects were established perpendicular to each other at each plot location. In 2006, this was changed to a single 100-meter transect at each plot location. At every meter along each transect a pin was dropped, and every species (or bare ground or thatch) touching the pin and their height was recorded. In 2006, disturbance factors were recorded at each pin location, if present, and the grazing intensity across each plot (low, medium, high) was noted. In addition, using the same 100 meter transects, a two meter wide belt transect was established at each plot location. Every plant species within the belt transect was recorded.

Biomass samples were collected in October 2005, January 2006, May 2006, and October 2006. At each plot location, between two and four (typically three) biomass samples were collected. Biomass samples were obtained by collecting all above-ground biomass, including rooted vegetation and thatch, from within a 13.25-inch interior diameter hoop (hoop area is 0.96 feet^2). The collected vegetative material was air-dried and weighed. The weight in grams was converted to pounds per acre (lbs/acre) by multiplying by 100. For the purposes of this document, biomass refers to vegetative material collected in the spring at peak growth (May samples) and Residual Dry Matter (RDM) is material collected in the fall and early winter when annual plants are dead (October and January samples). Thus, RDM represents the vegetative material remaining in the grasslands prior to the following year's new growth.

The native bunchgrass, purple needlegrass (*Nasella pulchra*), was present in portions of the Preserve. At each plot, all individual purple needlegrass bunches within a 2-m wide x 100 m belt transect were counted.

Photo-monitoring was conducted in both 2005 and 2006. Photographs were taken at monitoring plot 14 in each of the four cardinal directions.

Table 4. Grassland plots and survey year.

Plot Number	2005 Vegetation and Biomass	2006 Vegetation and Biomass	2005 Biomass Only
1		X	
2	X		
3	X	X	
4	X	X	
5	X	X	
6	X	X	
7	X	X	
8	X		
9	X	X	
10	X	X	
11	X	X	
12		X	
13		X	
14	X	X	
15		X	
16	X	X	
17	X	X	
18	X	X	
19		X	
20	X	X	
21		X	
22		X	
23		X	
24		X	
30			X
31			X
32			X
33			X
34			X
35			X
36			X
37			ND
38			X

ND = No data collected

Data analysis

For the purposes of this report, survey results were generally summarized by geographic areas supporting differential habitat quality for Stephens' kangaroo rat, as discussed in Section 3.1.1. Table 5 shows the distribution of grassland monitoring plots among SKR habitat quality categories. For all vegetation metrics (e.g., percent cover, average height, or biomass), a single value was derived for each plot and then a mean value calculated for each Stephens' kangaroo rat habitat quality category by averaging the plots within that category. For data collected with the point intercept methodology, absolute percent cover for each species (or bare ground or thatch) was calculated as the number of points that hit that species divided by the total number of points. Average height was calculated as the average of all height measurements recorded for each species at each plot. Similarly, average biomass within each plot was the average of the replicate samples collected at each plot.

Table 5. Grassland monitoring plots relative to SKR habitat quality rankings. Note: there are no grassland monitoring plots 24-29.

Plot Number	Habitat Quality	Plot Number	Habitat Quality	Plot Number	Habitat Quality
1	Low	12	Low	23	Low
2	Low	13	Low	24	Low
3	Medium	14	Low	30	High
4	Low	15	High	31	Low
5	Low	16	Low	32	High
6	Low	17	Low	33	High
7	Medium	18	Low	34	High
8	Medium	19	Low	35	Medium
9	Medium	20	Low	36	High
10	High	21	Medium	37	Medium
11	High	22	High	38	Low

3.1.3 Raptors

Detailed raptor survey methodologies can be found in *Wintering Raptors of the Cagney Ranch and Surrounding Ramona Grasslands (2003-2006)* (Wildlife Research Institute [WRI] 2007, Appendix B), and are summarized below.

Historical Data

Raptor observational data were compiled from WRI's winter Hawk Watch in the Preserve, held January through February in 2003, 2004, 2005, and 2006. These observations focus primarily on the grasslands around the WRI property and along Rangeland Road, just north of WRI, with supplemental observations north of Voorhes Lane and surrounding the Ramona Airport (Figure 2). Wintering raptor survey sites are shown in Figure 5. In 2003, 2004, and 2005 only sites 1-3 were surveyed, and all three of these years contain some weeks in which two days of observation data were collected. Few documented observations were made at sites 4-7 during these years. For 2003 only, observations started in December and covered the time frame between December 28, 2002 and February 2, 2003. Although observations were made for ten weeks in 2005, written documentation for that year is limited.

Current Data Collected (Year 2006)

Data specific to the Baseline Conditions project was collected during January and February 2006, when migrating raptors are most likely to be in the area and all raptors are more visible due to decreased foliage in trees along Santa Maria Creek. Surveys were performed one day per week from January 1 through February 28, 2006 at monitoring sites 1-3 (Figure 5). Between January 14 and January 28, 2006, data were collected for three days at all sites.

Observations were made from 0900 to 1200 hours at sites 1-3, with approximately one hour spent observing at each site. The data from sites 4-7 were collected on three separate surveys conducted between January 14 and January 28, 2006. The surveys were conducted for two hours between 1200 and 1400. A total of fifteen minutes of observations were collected at each of the three sites. Multiple observers performed the initial spotting of raptors and one experienced raptor biologist identified and recorded observations for individual species. Observations were recorded on a standard observation form. Observations were made with Kowa 10 x 42 binoculars and 10 x 20-60 zoom scopes were used in raptor identification.

Data Analysis

The numbers of wintering raptor surveys varied greatly among years. Numbers of surveys by year were: 2003 = 10, 2004 = 8, 2005 = 4, and 2006 = 13 (WRI 2007, Appendix B). Therefore, for purposes of this report, the mean number of raptors for each survey year was calculated by averaging the count of each raptor species for all surveys during a given year. All nesting locations were mapped in the field.

3.2 Vernal Pools, Vernal Swales, and Alkali Playas

Monitoring was conducted on ephemeral aquatic habitats in the Preserve to characterize hydrology and water characteristics, faunal communities, and composition of vegetation communities. Ephemeral aquatic habitats in the preserve include vernal pools, vernal swales, and alkali playas. Vernal swales are natural linear depressions that are part of the surface drainage network of Santa Maria Creek, and periodically pond and function like vernal pools. Vernal pools, vernal swales, and alkali playas monitored in the Preserve are shown in Figure 5. Monitoring in 2005 did not start until January, after pools began filling in October of 2004. Thus, some of the information on pool hydrology and fauna may not accurately represent the true conditions at the monitored locations.

3.2.1 Vernal pool, vernal swale, and alkali playa vegetation

Field surveys

Quantitative vegetation surveys of the vernal pools were conducted from April – July 2005 and during May 2006. At each pool, one transect was established on randomly selected compass bearing and a second established perpendicular to the first. Ten, 10 cm x 50 cm quadrats were randomly selected across these transects, generally five quadrats to each transect. Each quadrat was assigned to a visually estimated depth zone within each pool: 1) center (deepest area),

2) intermediate, and 3) pool edge (upland transition). The cover of all plant species (including bare ground and thatch) was recorded within each quadrat. In 2006, any disturbances associated with each quadrat were recorded, and grazing intensity (low, medium, high) was visually estimated. All species found in a pool, whether or not present in a quadrat, was separately recorded for each vernal pool. All field surveys were conducted by DPR staff Fred Sproul and Gena Calcarone.

Photo-monitoring was conducted in both 2005 and 2006. Photographs were taken at vernal pools e44, e45, e53, and e54 in each of the four cardinal directions.

Data analysis

For purposes of this report, vegetation data are summarized as percent absolute cover by averaging the quadrats within each depth zone for each pool. Thus, species-specific percent cover estimates are calculated separately for each zone in every pool, and pools serve as the sampling unit for summarizing vegetation data. Pools, swales, and alkali playas were grouped into geographic complexes for purposes of data summary and presentation. These surveyed pools, and the complexes to which they were assigned, are summarized in Table 6. The locations of individual surveyed pools are shown in Figure 5.

Table 6. Geographic complexes supporting surveyed vernal pools, vernal swales, and alkali playas.

Airport Vernal Pools	Cumming Vernal Swale	Cagney Swale	Cagney Vernal Pools	Alkali Playa
e44	ev1	vs1	e56	RAAP100
e45	ev2	vs2	e58	
e46		vs3	e59	
e52		vs4	e62	
e53				
e54				
e77				
r24				

3.2.2 Hydrology and water characteristics

Hydrology and water characteristics methodologies for vernal pools can be found in *Biological Survey Report for the Ramona Grasslands Preserve* (RECON 2005, Appendix C), and are summarized below.

In January 2005, a staff gauge was installed in each of the study vernal pools. Staff gauges were constructed of 24-inch-long sections of 1-inch diameter polyvinyl chloride (PVC) pipe, fitted over 30-inch-long sections of 1/2-inch diameter rebar. The gauge was fitted so the PVC pipe and rebar were flush on one end, and the flush end was capped to indicate the top of the gauge. From the base of each cap, marks were placed at 1-inch increments to indicate depth. Self-adhesive numbers indicating the pool's identity were placed vertically down the gauge, opposite the side with the 1-inch hash marks. The staff gauge was then driven into the ground so that the bottom hash mark, indicating zero inches, was flush with the ground in the deepest portion of each pool. Water depth was monitored weekly from January 21, 2005 to April 19, 2005. Water depth to an accuracy of 0.25 inch was recorded for each vernal pool on each date. For purposes of analysis and presentation in this report, water depth was averaged across vernal pools within complexes shown in Table 6.

Dissolved oxygen levels in each vernal pool were monitored monthly using a LaMotte Dissolved Oxygen Test Kit (Code 7414/5860). Dissolved oxygen testing followed instructions and procedures as outlined in the Dissolved Oxygen Test Kit manual. Water temperatures were recorded every two weeks. In addition, anecdotal information on conductivity (a measure of the amount of dissolved solids, such as salts, in water) was collected in several alkali playas and several vernal pools in the Airport complex in March 2005.

3.2.3 Fauna

Methodologies for vernal pool faunal surveys can be found in *Biological Survey Report for the Ramona Grasslands Preserve* (RECON 2005, Appendix C), and are summarized below.

Fairy shrimp

Fairy shrimp surveys were conducted according to U.S. Fish and Wildlife Service (USFWS) survey guidelines (USFWS 1996) every two weeks, starting January 21, 2005 and ending April 1, 2005. During each survey, the following steps were followed at each pool:

1. Prior to disrupting the water surface of the pool, if the view was relatively clear and unobstructed, the surveyor examined the pool for fairy shrimp to estimate the number of shrimp present.
2. Air temperature, water temperature, and maximum water depth [using staff gauges (see Section 3.2.1 above)] were recorded.
3. Using an aquarium fish net attached to an extendable painters pole, the surveyor made three-foot-long sweeps through the water to catch any fairy shrimp or other aquatic species that may have been present. All species caught in the net were examined, identified, and then returned to the pool; except fairy shrimp samples that were collected for identification and accessioning.
4. Step 3 was repeated in different locations around the vernal pool approximately 15 to 30 times depending on the size of the vernal pool.

Vernal pool amphibians

Amphibian surveys focused on species that occur in vernal pools such as western spadefoot toad (*Spea hammondi*), Pacific tree frog (*Pseudacris regilla*), and western toad (*Bufo boreas*). These surveys were conducted every two weeks, between January 21 and April 1, concurrent within fairy shrimp surveys. At each pool, the presence or absence, estimated number (e.g. 10s, 100s, 1000s, etc.), and the lifecycle stage (e.g. egg cluster, tadpole, or toadlet) of each species was noted.

3.3 Santa Maria Creek Corridor

Surveys were conducted in the Santa Maria Creek corridor to characterize water quality, channel geomorphology, vegetation composition and structure, breeding season avifauna, and the distribution of arroyo toads.

3.3.1 Water quality

Water quality monitoring in Santa Maria Creek was conducted by the City of San Diego Water Department. The water quality monitoring program established three sampling locations: SMC1 is located immediately upstream of the Ramona Grasslands, SMC3 is located in the central portion of Santa Maria Creek in the project area and is within a reach of the creek traversing privately owned residential properties, and SMC2 is located immediately east of the Rangeland Road bridge (Figure 5). Santa Maria Creek was sampled twice monthly during 2005 and early 2006, when stream flow was present. Sampling was conducted per the Santa Maria Creek Restoration Water Quality Monitoring Plan, prepared by the City of San Diego Water Quality Laboratory (2004). Temperature, pH, oxidation-reduction potential (ORP), dissolved oxygen (DO) and specific conductance, and stream flow were measured in the field. All other chemical parameters were analyzed in the City of San Diego Water Quality Laboratory.

3.3.2 Channel geomorphology

The channel geomorphology of Santa Maria Creek was measured at ten cross sections in the Preserve (Figure 5). Vertical elevation-horizontal distance pairs were measured in the field using survey equipment, providing the cross-sectional shape of the channel, while GPS coordinates provided the latitude and longitude of the benchmarks (right and left end points of the cross-sections). Approximate bankfull geometry for each cross-section in the Santa Maria Creek reach was established from standard field observations and measurements. All cross-sections were standardized to read from river left (RL) to river right (RR) when the observer is looking downstream. Channel geomorphology is presented in real elevations (meters above mean sea level). All field surveys were conducted by Molly Pohl-Costello and Michael White.

3.3.3 Riparian vegetation

At each cross-section location (Figure 5), riparian vegetation community composition and structure was measured using a line-intercept methodology. At each location, a transect line was established across the creek channel. The intercept lengths of individual plant species in the canopy layer, shrub layer, and herb layer along each transect was recorded. In 2006, the herb layer was quantified using a point-intercept methodology (i.e., recording the species touching a pin dropped every one-half meter along the prescribed transect). In addition, all riparian shrub and tree species were counted within a 2-meter belt transect at each location and categorized as seedlings or adults. All field surveys were conducted by DPR staff Fred Sproul and Gena Calcarone.

Photo-monitoring was conducted in both 2005 and 2006. Photographs were taken at each location.

3.3.4 Avifauna

Detailed survey methodologies for riparian avifauna can be found in *Biological Survey Report for the Santa Maria Creek Restoration Project: riparian birds* (Lovio 2007, Appendix D), and are summarized below.

A breeding-bird census (Van Velzen 1972) was conducted for riparian vegetation along Santa Maria Creek, utilizing a technique known as “spot-mapping” (Bibby et al. 1992, Ralph et al. 1993). Under the assumption that pairs of breeding birds occupy regular areas that are at least partially exclusive of other pairs of the same species during the breeding season and that territorial birds advertise their presence by visual and auditory clues, census areas are completely and systematically surveyed on multiple visits during a single breeding season. The breeding-bird census was conducted on seven dates over a period of 37 days between mid-May and mid-June, 2005. During each census visit, the locations and behaviors of individuals of all species detected were recorded on a map of the census area. Over repeated visits, the cumulative map registrations for each species tended to form distinct clusters that represent different pairs of a given species.

Daily census visits were begun shortly after dawn to maximize the use of higher morning bird activity. Starting points on the creek and directions of movement were varied among the census visits, such that each section of the creek was covered at various times of day throughout the census period in an effort to minimize bias from differences in bird activity attributable to time of day. Bird locations for all species were marked on a separate high-resolution aerial photograph for each visit and associated demographic and behavioral data were recorded on a standard data form.

Interpretation of summary maps for the various species involved two somewhat overlapping steps: 1) Initial recognition of map clusters that likely represent separate breeding pairs or other units of the species. This step employed several basic criteria for qualifying any group of map registrations as a potential breeding unit of a species: a) Some level of obvious clustering of registrations relative to the overall dispersion of registrations for the species throughout the study area; criteria for clustering accounted for the scale of movement (generally the reciprocal of density) of the particular species; b) inclusion of registrations from a minimum of three dates spanning at least two weeks (approximately half of the 37-day span of the census period); c) presence of a nest or other definitive evidence of nesting if criteria a or b were lacking or insufficient. 2) Separation of clusters from adjacent clusters of the same species. Clues involved in this process included: a) gaps between clusters in otherwise continuous habitat; b) simultaneous or nearly simultaneous territorial displays by adjacent pairs; c) counterpart territorial registrations close in time in each cluster on one or more dates (greater confidence of distinctness of clusters with more dates).

The bird census was conducted uniformly along the entire study area, irrespective of habitat types and political boundaries. However, in the locational data analysis, map registrations and breeding territory cores (clusters) were recorded as occurring within any of six stream reaches (A-F) that correspond to property boundaries (Figure 5). Habitat within each of these segments is fairly uniform as a result of natural and anthropogenic factors and, with the exception of Reach A, the lengths of the segments are roughly comparable. The delineation of these segments, and the categorization of bird data within them, provides for simultaneous avifaunal comparisons among the habitat types.

3.3.5 Arroyo toad

Detailed methodologies for arroyo toad surveys conducted in 2005 can be found in *Biological Survey Report for the Ramona Grasslands Preserve* (RECON 2005, Appendix C). Detailed methodologies for arroyo toad surveys conducted in 2006 can be found in *Biological Survey/Monitoring Report for the Santa Maria Creek Restoration Project: arroyo toads* (Hollingsworth et al. 2006, Appendix E). These methods are summarized below.

Day and nighttime directed sight surveys for arroyo toads were conducted along Santa Maria Creek with the TNC Oak Country Estates portion of the Preserve between March 16 and June 14, 2005, and the entire Preserve on May 31 and June 12, 2006. These surveys followed the guidelines of the U.S. Fish and Wildlife Service (1999) and in 2006 were augmented with recommendations from United States Geological Survey (USGS 2005). On each survey date, two to three biologists walked along the edge or within the creek to detect the presence or absence of arroyo toads. Surveys were confined to the main channel of the creek bed; upland habitats beyond the banks of stream channel were not surveyed.

Data were recorded on datasheets and in field notebooks to document life stage, time, location, habitat, air and water/substrate temperatures, and signs of disturbance. In 2006, photographic vouchers were recorded for all sight records provided the animal’s position allowed for photography, and locations were recorded with a handheld Garmin Legend GPS unit using an accuracy reading of six meters or less. A handheld Coleman lantern, Canon high intensity video light, and headlamps assisted nighttime surveys.

3.4 Invasive Nonnative Plant Removal

The locations of invasive nonnative plant species in the Preserve were initially identified by TNC in 2004, and included artichoke thistle, intermediate wheatgrass, giant reed, and salt cedar. New locations of these species were identified during removal efforts in 2005 and 2006 and were treated when detected. Previously unmapped invasive nonnative plants species were detected in the Preserve during 2005 and 2006 removal efforts, and included milk thistle, Italian thistle, horehound, and perennial pepperweed (RECON 2005 and Kelly & Associates 2007, Appendices C and F). Invasive nonnative plants were found throughout the Preserve properties, often times adjacent to sensitive or rare biological resources. Due to the sensitive nature of many flora and fauna in the Preserve, extra care was taken when selecting the methodology for removal of invasive nonnative plants. Invasive nonnative plants were treated repeatedly through 2005 and 2006, and an additional treatment is anticipated during the winter of 2007.

A mixture of hand removal, and herbicide use was employed to accomplish the invasive nonnative plant removal objectives. Herbicide was employed most frequently, and a 50-gallon truck sprayer was used when dense concentrations of plants occurred, while backpack sprayers were used in less dense situations. An alternative herbicide application method was the "cut stump" technique used on arundo and saltcedar. In the cut stump technique, the saltcedar or arundo plant is cut with loppers, chainsaw, or handsaw, then a concentrated herbicide is applied to the cut stump within one minute of cutting. Herbicides used for invasive plant removal included Transline® and AquaMaster™. Transline®, clopyralid, Garlon 4a, Pathfinder (a pre-mix of Garlon 4a in a seed oil base), Glypro Pro (a Glyphosate herbicide, a generic Roundup), and Fusilade II. See *Biological Survey Report for the Ramona Grasslands Preserve* (RECON 2005, Appendix C) and *Invasive Weed Report for the Santa Maria Creek Restoration Project: grassland and riparian invasive weed control efforts and results* (Kelly & Associates 2007, Appendix F) for details of herbicide applications.

4.0 RESULTS

Lists of plant and animal species detected in the Preserve, including their sensitivity status, are provided in Attachments A and B respectively. Photographs of selected sensitive species are provided in Attachment C

4.1 Grasslands

4.1.1 Stephens' kangaroo rat

Detailed results SKR surveys are provided in *Biological Survey Report for the Santa Maria Creek Restoration Project: Stephens' kangaroo rat,* (Spencer and Montgomery 2007, Appendix A), and are summarized below. SKR is federally endangered, state threatened, and a County of San Diego Group 1 species.

The majority of suitable and occupied SKR habitat is distributed in a broad, arcing mosaic of mostly well-drained, hilly topography near the center of the grasslands, with smaller mosaics or isolated pockets of suitable habitat scattered in other areas (Figure 6). The largest, most contiguous concentration curves around the west end of the Ramona Airport and extends west to Rangeland Road in those areas not used as effluent spray fields.

A second concentration of SKR habitat occurs in association with the northern fringe of the grasslands, where hills supporting coastal sage scrub rise up from the grasslands on the northern portion of Davis-Eagle Ranch. Both SKR and DKR were captured in this northern fringe area (Figure 6), with SKR occurring in the more open or down-slope portions, and DKR more in the edges of the coastal sage scrub and along a dirt road through sage scrub. Some habitat polygons found to have sign of kangaroo rats in this area were therefore omitted from SKR density polygons in Figure 6, as it was concluded they were unlikely to support SKR and highly likely to support DKR.

Smaller and more isolated pockets of habitat are found outside these two primary concentrations or core areas of habitat. On TNC Oak Country Estates, SKR was captured on a broad sandy flood plain near Santa Maria Creek, which was mapped as occupied at trace densities (although it may qualify as occupied at low densities). Several small pockets of trace or potential SKR habitat was mapped on and around isolated rocky hills on TNC Oak Country Estates, SKR presence was confirmed during previous trapping surveys (O'Farrell 2000b, 2002). Other isolated pockets of trace-occupied or potential habitat are also associated with rocky hills rising out of less suitable clay soils on portions of Cagney and Davis-Eagle Ranch, including some between the RMWD effluent spray fields.

Most areas mapped as unsuitable for SKR consist of heavier clay soils, such as eastern portions of Cagney and Davis-Eagle Ranch, much of TNC Oak Country Estates, and all of the Hardy and Cumming properties. Heavier clay soils also separate the large mosaic of habitat in the middle of the grasslands from the occupied areas along the northern fringe. Loose alluvial soils in the floodplain of Santa Maria Creek in the southern part of Cagney Ranch are also not occupied by SKR. This may be attributed to one or more of the following hypotheses: (1) these very loose, sandy soils may not be able to sustain SKR burrows, which may collapse easily in them; (2) occasional flooding by Santa Maria Creek may eliminate SKR from the area (drowning, wetting, and displacement); and (3) denser than average growth of annual grasses and associated thatch, perhaps due to lesser grazing intensity or elevated ground water.

The creation of the effluent spray fields in the western portions of Davis-Eagle Ranch may have apparently rendered some previously suitable habitat unsuitable, due to saturation of the soil and creation of dense, irrigated vegetation. Previously the mosaic of occupied habitat patches was probably more contiguous through this area. Although a few pockets of well-drained soils between the sprayfields are currently occupied, and more areas are probably occupied in years of expanded SKR populations, for the most part the interstices between spray fields appear to be somewhat degraded in habitat quality due to drifting spray, which elevates soil moisture relative to natural conditions. Only the larger and better drained rises between spray fields are likely to reliably support SKR from year to year.

Considered together, all these observations indicated that SKR populations were very low but relatively stable over the survey period, with little evidence of population expansion or contraction during 2005-2006 (but following a dramatic contraction from 2004 to 2005; Haas and O'Farrell 2005). The winter of 2004-2005 was the wettest on record at the Ramona Airport (29.03 inches of rain), which led to extraordinary growth of grasses during 2005. The SKR population contracted in response to this change in vegetation, with SKR persisting only in the most well-drained and highly suitable soils. The population did not appear to expand significantly in the drier conditions of 2006.

4.1.2 Grassland vegetation

A variety of rare plant species were detected in the Preserve (Figure 7), including:

San Diego thornmint (*Acanthomintha ilicifolia*); FT, SE, County List A
Dwarf peppergrass (*Lepidium latipes* var. *latipes*)

Little barley (Hordeum intercedens); County List C
Small-leaved morning-glory (*Convolvulus simulans*); County List D
Round-leaved filaree (*California macrophylla*); County List B
Southern tarplant (*Centromadia parryi* var. *australis*); County List A
Graceful tarplant (*Holocarpha virgata* ssp. *elongata*); County List D

(FT = federally threatened, SE = California Endangered, County List A = plants rare, threatened or endangered in California and elsewhere, County List B = plants rare, threatened or endangered in California but more common elsewhere, County List C = plants that maybe quite rare, but need more information to determine their true rarity status, County List D = plants of limited distribution and are uncommon, but not presently rare or endangered)

The majority of these species are associated with clay soils, which are generally found around the margins of the Preserve (Figure 7). Small-leaved morning-glory, round-leaved filaree, and San Diego thornmint are only found in the eastern portion of the Preserve on the flanks of the knoll on the Hardy Ranch property. Purple needlegrass is scattered on clay soils throughout the Preserve, where it is often associated with graceful tarplant, but is particularly abundant on the southern portion of TNC Oak Country Estates. Little barley is known at one location in the eastern-central portion of the Preserve. Southern tarplant is abundant in the east-west trending swale north of Santa Maria Creek.

Species richness

The grasslands support a moderately rich assemblage of plant species, although a small number of these species were most frequently detected in grassland plots and these are largely nonnatives. Grassland plots with the highest number of species (> 30 species per plot) were generally associated with rocky knolls (e.g., Plot #3, 9, 14, and 19; Figure 5 and Attachment E). A total of 110 taxa were recorded in the grassland plots in 2005 and 2006 (Attachment E). However, 12 of these taxa (highlighted in Attachment E) were found in 16 or more of the 24 grassland plots, representing an average frequency of 5% of the total species in each grassland plot. Of these 12 frequently occurring species, only 3 of these taxa are native to the grasslands. Sixty seven of the 110 taxa were only found in 5 or fewer plots, representing an average frequency of 1.4% of the total number of species in each plot.

Structure and composition of grasslands

Cover in the grasslands tended to be dominated by nonnative annual grasses and forbs, primarily slender wild oat (*Avena barbata*), ripgut grass (*Bromus diandrus*), long-beaked filaree (*Erodium botrys*), Italian ryegrass (*Lolium multiflorum*), common catchfly (*Silene gallica*), and hairy rat-tail fescue (*Vulpia myuros* var. *hirsuta*) (Figure 8). The structure and composition of grassland habitats tended to vary among the three categories of SKR habitat quality. While no statistical differences were detected, the amount of bare ground, the cover of forbs, particularly from *Erodium* spp., and the forb to grass ratio tended to be higher in high quality habitat. Higher cover of annual grasses and thatch were observed in lower quality habitat.

The exceedingly wet fall and winter of 2004-2005 produced dense growth of grassland vegetation. Vegetative cover was higher across all SKR habitat quality categories in 2005, with the cover of slender wild oat, long-beaked filaree, and Italian ryegrass particularly high (Figure 8). In 2006, these species, along with ripgut grass, provided the highest contributions to grassland cover, but at lower levels than observed in 2005.

Although statistical differences were not found, RDM in 2006 was on average lower in high quality SKR habitat than in either medium or low quality SKR habitat (Figure 9a). High quality SKR habitat had a mean RDM of approximately 1,800 lbs/acre, whereas medium and low quality habitat had mean RDMs over 2,300 lbs/acre. In addition, the variability of RDM (as measured by standard errors in Figure 9a) is greatest in low quality habitat, suggesting that higher quality SKR habitat is characterized by consistently low RDM levels. In their analysis of these data, Spencer and Montgomery (2007) suggest that high quality SKR habitat is characterized by a threshold RDM level of less than 3,000 lbs/acre. Spring biomass and fall RDM were moderately correlated in 2006 (Figure 9b). Spring biomass was approximately twice the fall RDM levels in 2006.

Photomonitoring data

Representative photographs of the grasslands in the Preserve are provided in Attachment D (Figure D1). These photographs show the dominance of nonnative grasses, primarily slender wild oat, in the Preserve. Note the taller grasses in the 2005 photograph indicative of the heavy rainfall of that year.

4.1.3 Raptors

Detailed results of raptor surveys in the Preserve can be found in *Wintering Raptors of the Cagney Ranch and Surrounding Ramona Grasslands (2003-2006)* (WRI 2007, Appendix B), and are summarized in this section.

The grasslands and Santa Maria Creek riparian corridor in the Preserve support both wintering and breeding habitat for a diverse raptor community. A number of raptors detected in the Preserve are considered sensitive, including:

Bald eagle (*Haliaeetus leucocephalus*); SE, FP, County Group 1
Golden eagle (*Aquila chrysaetos*); FP, CSC, County Group 1
Ferruginous hawk; CSC, County Group 1
Northern harrier (*Circus cyaneus*); CSC, County Group 1
Merlin (*Falco columbarius*); CSC, County Group 1
Praire falcon (*Falco mexicanus*); CSC, County Group 1
Barn owl (*Tyto alba*); County Group 2
Burrowing owl (*Athene cunicularia*); CSC, County Group 1
White-tailed kite (*Elanus leucurus*); FP, County Group 1
Cooper's hawk (*Accipiter cooperii*); CSC, County Group 1
Red-shouldered hawk (*Buteo lineatus*); County Group 1

(SE = California Endangered, FP = California Fully Protected, CSC = California Species of Concern, County Group 1 = animals threatened or endangered or with specific natural history requirements, County Group 2 = animals becoming less common, but not yet so rare that extirpation or extinction is imminent without immediate action)

A diverse assemblage of raptor species used the Preserve during winter months (Figure 10). WRI (2007) noted that the wintering data for 2005 were likely an under-estimate of the average abundance of raptors in the Preserve because data for February and March of that year were not included in the average. The most abundant raptor species using the Preserve from 2003-2006, include American kestrel (*Falco sparverius*), ferruginous hawk, red-tailed hawk (*Buteo jamaicensis*), and turkey vulture (*Cathartes aura*). Burrowing owl, golden eagle, and prairie falcon also consistently used the Preserve, albeit in low numbers. Fewer than two burrowing owl individuals were typically seen during surveys from 2003-2005, but as many as five individuals were seen in 2006. Only one to two golden eagle and prairie falcon individuals were observed on any survey date. The maximum number ferruginous hawk observed in the Preserve from 2003-2006 was eight individuals (CBI 2007).

Raptors breeding in the Preserve included American kestrel, burrowing owl, barn owl, great-horned owl (*Bubo virginianus*), red-tailed hawk, red-shouldered hawk, and white-tailed kite (Figure 11). Red-shouldered hawk were by far the most frequent breeding species within and in areas immediately adjacent to the Preserve. These species generally used native trees along the Santa Maria Creek corridor and various nonnative trees scattered within and around the Preserve (e.g., eucalyptus) for nesting, except for burrowing owls which used artificial next boxes on the WRI property.

4.2 Vernal Pools, Vernal Swales, and Alkali Playas

4.2.1 Vernal pool, vernal swale, and alkali playa vegetation

Several rare plant species were detected in vernal pools and alkali playas in the Preserve (Figure 7), including:

Parish’s brittlescale (*Atriplex parishii* var. *parishii*); County List A
Coulter’s saltbush (*Atriplex coulteri*); County List A
Small-flower microseris (*Microseris douglasii* ssp. *platycarpha*); County List D

Species richness

There was considerable variation in the plant species present in ephemeral aquatic habitats in the Preserve. Attachment F shows all species detected in each vernal pool surveyed in 2005 and 2006. A total of 98 taxa were recorded across all vernal pools; however, only 23 of these taxa (highlighted in Attachment F) were detected in more than half of the pools. Eleven of these 23 taxa are nonnative.

Although there was substantial overlap, the vernal pool complexes considered in this report did show some unique species assemblages (Attachment F). For example, the reaches of the Cagney swale generally had higher taxonomic richness than other ephemeral aquatic habitats in the Preserve, including the highest number of species (42) recorded. Pools in the Airport complex were the only pools in the Preserve to support cryptantha (*Cryptantha* sp.), annual hairgrass (*Deschampsia danthonioides*), blue dicks (*Dichelostemma capitatum* ssp. *capitatum*), toothed downingia (*Downingia cuspidate*), smooth boisduvalia (*Epilobium pygmaeum*), dwarf peppergrass (*Lessingia filaginifolia* var. *filaginifolia*), grab lotus (*Lotus hamatus*), small-flower microseris (*Microseris douglasii* ssp. *platycarpha*), common muilla (*Muilla maritima*), dot-seed plantain (*Plantago erecta*), blue-eyed-grass (*Sisyrinchium bellum*), and tree clover (*Trifolium ciliolatum*). The pools on Cagney Ranch (outside of the airport complex) were the only pools to support red maids (*Calandrinia ciliate*), American pillwort (*Pilularia americana*), and white tip clover (*Trifolium variegatum*). Although not all were detected in playa RAAP 100, the alkali playas were the only habitats to support Parish's brittlescale (*Atriplex parishii* var. *parishii*), Coulter's saltbush (*Atriplex coulteri*), and veiny peppergrass (*Lepidium oblongum* var. *insulare*).

Species composition by pool zone

The relative species composition varied both within pool zones and between the complexes (Figure 12). Across both years sampled, there was generally a lower percentage of bare ground within pool centers in the Airport complex relative to pools in the other complexes due to a high cover of Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*), annual beard grass (*Polypogon monspeliensis*), woolly marbles (*Psilocarphus brevissimus* var. *brevissimus*), long-beaked filaree, toothed downingia, and iris-leaved rush (*Juncus xiphiodes*). The pools in the Cumming swale had higher cover contributions from hairy clover fern (*Marsilea vestita*), and this species was only found in the center zone of pools where it was present. The cover of *Avena* and *Bromus* species were low in the centers of pools in all complexes.

Averaging across the two years sampled within the intermediate zone of the pools, species composition tended to be more uniform across complexes, although woolly marbles and iris-leaved rush did contribute more to the cover in the Airport complex than in other complexes. At the upland edges of the pools, the cover of slender wild oat and ripgut grass increased. Long-beaked filaree generally tended to increase in its contribution to cover moving from the center to upland edges of pools.

Total cover was generally higher in all complexes in 2005. The other notable change was the increase in cover of Bermuda grass (*Cynodon dactylon*) in the alkali playa (RAAP 100) in 2006 (Figure 12).

Photomonitoring data

Representative photographs of the vernal pools in the Preserve are provided in Attachment D (Figures D2). Figure D2 shows the conditions of vernal pool e44 in the Airport Complex. Note the extensive cover of nonnative grasses.

4.2.2 Hydrology and water characteristics

Detailed vernal pool hydrologic monitoring results are provided in *Biological Survey Report for the Ramona Grasslands Preserve* (RECON 2005, Appendix C). Vernal pool monitoring did not begin until well after the start of the rainy season in October 2004, and by January 21, 2005 nearly 17 inches of rain had been recorded at the Ramona Airport. Thus the trends summarized below are only representative of the latter half of the rainy 2004/2005 season.

Vernal pool hydrology varied by vernal pool complex (Figure 13), although the hydrology of individual pools within a complex was fairly variable. For example, the Cumming and Cagney swales supported the deepest and most persistent pools. One of the two pools sampled in the Cumming swale (ev1) has been impounded, presumably to provide a water supply for cattle. The Cagney swale has been incised by runoff from the Ramona Airport tarmac, thus creating relatively deep and persistent pools. The monitored alkali playa (RAAP 100) is large relative to the other playas but also appears to sit within a swale that is fed by runoff from both the northern portion of Cagney Ranch and, as in 2005, periodic overbank flow from Santa Maria Creek. The vernal pools in the Cagney and Airport complexes were the shallowest and least persistent of all of the ephemeral aquatic habitats in the Preserve. The Airport complex has pools with “typical” vernal pool basin morphology (i.e., mima mound topography) and hydrologic function, whereas the Cagney pools mostly lie within the east-west trending swale (which also supports the alkali playas) and may have hydrology influenced by the network of swales in the Preserve (i.e., have a larger watershed area relative to the Airport complex) and by overbank flow from Santa Maria Creek. Vernal pools in the Airport complex dried earlier than pools in the other complexes; however, if pool e59, which does not lie in the east-west trending swale is removed from the analysis, the remaining three pools in the Cagney complex dried earlier than the Airport pools.

The conductivity of alkali playas measured in March 2005 ranged from 1,890 microsiemens (µS) to over 1,990 µS, whereas the conductivity of vernal pools in the Airport complex was less than 150 µS. Water temperatures were quite variable during the 2005 survey period, ranging from 61 ºF to 79 ºF. Biweekly water temperature fluctuations of 4 ºF to 6 ºF within pools were common (RECON 2005, Appendix C). Dissolved oxygen concentrations of vernal pools were typically above 9 mg/l (RECON 2005, Appendix C), well above 100% saturation concentrations given the temperatures of the pools at the time of measurement. An anomalous reading of 2.4 mg/l was recorded for vernal pool e45 on April 1. Interestingly, the dissolved oxygen concentrations of the only alkali playa monitored (RAAP 100) ranged from 7.0 to 8.6 mg/l, uniformly lower than the dissolved oxygen concentrations measured in vernal pools on the same dates. Elevated concentrations of dissolved solids in water lower saturation concentrations, and the high conductivity of the alkali playas appears to be reflected in their lower dissolved oxygen concentrations.

4.2.3 Fauna

Detailed results of faunal surveys are provided in *Biological Survey Report for the Ramona Grasslands Preserve* (RECON 2005, Appendix C). These results are summarized below for the two target taxa in this report, San Diego fairy shrimp and spadefoot toad. San Diego fairy shrimp is federally endangered and is a County Group 1 species. Western spadefoot toad is a California species of concern and a County Group 2 species.

San Diego fairy shrimp

San Diego fairy shrimp were commonly detected in the Preserve. While all ephemeral aquatic habitats had suitable ponding conditions for San Diego fairy shrimp (i.e., ponding for at least 2-weeks), San Diego fairy shrimp were only detected in pools in the Airport complex (pools e45, e46, e52, e53), the Cagney complex (pools e56, e58, e59, e62), one station in the Cagney swale (vs1), and the alkali playa (RAAP 100). No other fairy shrimp species were detected in the Preserve. Interestingly, while these pools retained water well into March or April, the last observation of fairy shrimp was on the February 4 survey date, and the majority of pools only had fairy shrimp detected on the first survey date on January 21 (RECON 2005, Appendix C). Given the late start of vernal pool monitoring in the 2004/2005 rainy season, it is likely that many fairy shrimp may have already completed their life cycles prior to monitoring.

Western spadefoot toad

Western spadefoot toad larvae were detected in pools in the Airport complex (pools e46, e53, e77), the Cumming swale (ev1), and the Cagney swale (vs1, vs2, vs3, vs4). However, toadlets were only seen in pools e46 and vs3. It is not clear if spadefoot toads did not complete their lifecycles in the other pools where breeding was documented or if toadlets were just not detected at these pools. Two other amphibian species, western toad and Pacific tree frog, also successfully bred and metamorphosed in pools in the Cumming swale, Cagney vernal pools, Cagney swale, and the alkali playa (RAAP 100).

4.3 Santa Maria Creek Corridor

4.3.1 Water quality

Complete water quality monitoring results for 2005-2006 are provided as Attachment G of this report. In this section, the baseline water quality monitoring results for Santa Maria Creek is summarized by groups of parameters. Water quality data are presented in three-dimensional graphs with date on the x-axis, the parameter values (e.g., concentration) on the y-axis, and a separate curve for each parameter at each station organized along the z-axis. For each parameter, stations are identified by a gradient of color from lightest (most upstream) to darkest (most downstream). Water quality monitoring stations are shown in Figure 5. Thus, the changes in parameter values across the different sampling dates can be compared side-by-side for each monitoring station.

Temperature, dissolved oxygen, and pH

Figure 14 shows the monitoring results for temperature, dissolved oxygen (DO), and pH for the three monitoring stations. Temperature of the creek changed in a similar fashion among the three stations across the monitoring period. As expected, temperatures generally increased over the course of the calendar year, with maximum temperatures seen in late spring. Two dips in temperature were seen in March and April of 2005, corresponding to storms that lowered temperatures. DO concentrations and pH exhibited similar patterns at all stations over all sampling dates.

Stream flow and total suspended solids

Stream flow and total suspended solids (TSS) are shown in Figure 15. Stream flow peaked in February 2005 following heavy winter rains and tapered off through the remainder of the year. Rainfall during the winter of 2006 was very low, and thus stream flow only exhibited a minimal increase during this year. TSS tends to correlate with discharge, as higher velocity flows can carry higher suspended sediment loads. TSS concentrations were highest at SMC1 and SMC2 (the most upstream and downstream stations), and these stations have much less vegetation cover in the channel than SMC3.

Conductivity and total dissolved solids

Figure 16 shows the monitoring results for conductivity and total dissolved solids (TDS). Since conductivity reflects the presence of dissolved ions, it is not surprising that TDS and conductivity are well correlated across the monitoring period, except for a dip in TDS in March of 2005. Both conductivity and TDS showed a spike at the end of 2005 at the SMC3 station.

Total nitrogen and total phosphorus

Total nitrogen (TN) and total phosphorus (P) are shown in Figure 17. These two elements show similar patterns across the monitoring period, but TN exhibits much higher variations in concentration. There also appears to be a gradient of TN through the project area, with higher TN upstream and lower downstream. This may reflect inputs from the urban and agricultural land uses upstream of the project area. The concentration of P shows peaks that are correlated with stream flow magnitude, as particulate P is often absorbed to sediment. Nutrient concentrations fall dramatically as stream flow declines during the late spring and summer of 2005.

Total coliform bacteria

Total coliform bacteria are shown Figure 18. Total coliform bacteria levels are highest at SMC 1, potentially an indication of agricultural runoff from areas upstream of the Ramona Grasslands. Bacterial levels tend to decline across all sampling stations during the late winter and spring, suggesting that bacteria are being flushed into the stream during rainfall events. The exception to this pattern is a peak in total coliform levels in late May 2005 at SMC1 (most upstream station), which is not related to increased stream flow.

Chloride and sulfate

The concentrations of chloride and sulfate ions are shown in Figure 19. These ions exhibit very low concentrations early in 2006 but steadily increase over the later winter and spring of this year. The highest concentrations of chloride were seen at station SMC1 during later 2005 and 2006, possibly reflecting agricultural runoff.

4.3.2 Channel geomorphology

Cross-sections graphically displaying the geomorphology of the Santa Maria Creek channel are provided in Figures 20a and 20b. The Santa Maria Creek channel within the Preserve varies in width from 30 to 200 ft and in depth from 3 to 12 ft, although the active channel is generally confined to a small portion of the wider reaches of the channel (e.g., SG9, SG10, and SG11, Figure 20b). The channel generally becomes wider and more incised at the western end of the preserve.

4.3.3 Riparian vegetation

Riparian tree species in the Santa Maria Creek corridor largely consist of red willow (*Salix laevigata*), arroyo willow (*Salix lasiolepis*), black willow (*Salix gooddingii*), and Fremont cottonwood (*Populus fremontii*), with coast live oak (*Quercus agrifolia*) and western sycamore (*Platanus racemosa*) present at the western end of the Preserve. Riparian shrub species are dominated by mulefate (*Baccharis salicifolia*), and young willows, including narrow-leaf willow (*Salix exigua*) at the eastern end of the Preserve. The herbaceous layer at the western end of the Preserve is dominated by freshwater marsh species, including Olney's bulrush (*Schoenoplectus americanus*), yerba mansa (*Anemopsis californica*), Mexican rush (*Juncus mexicanum*), western ragweed (*Ambrosia psilostachya*), while upstream of Rangeland Road herbaceous species are dominated by yerba mansa, Mexican rush, mugwort (*Artemisia douglasiana*), water speedwell (*Veronica anagallis-aquatica*), cocklebur (*Xanthium strumarium*), great marsh evening primrose (*Oenothera elata* ssp. *hirsutissima*), creeping wild rye (*Leymus triticoides*), grass poly (*Lythrum hyssopifolium*), white sweet clover (*Melilotus alba*) and mulefat seedlings.

The Santa Maria Creek corridor currently has low vegetative cover, particularly tree cover (Figures 21a, b). Riparian transects 3, 4, and 5 have the highest tree cover in the Preserve; although the cover recorded at Transect 3 is not indicative of that stream reach, which actually has relatively little tree cover. Shrub cover is more uniform at 10-25%, except for Transects 2, 3, and 8 that have no shrub cover. Riparian tree and shrub species were producing seedlings each year (Table 7); however, the survival rate of these seedlings is unknown.

Photomonitoring data

Representative photographs of the riparian habitats in the Preserve are provided in Attachment D (Figures D3-D5). Figure E3 shows the virtual absence of riparian vegetation in Reach E of Santa Maria Creek as a result of historic cattle grazing. Figure D4 shows the woodland and shrubby understory structure of the riparian vegetation in Reach D of Santa Maria Creek. Figure D5 shows the mulefat scrub and freshwater marsh communities in Reach A of Santa Maria Creek.

Table 7. Total number of seedlings recorded at each riparian transect location.

Transect	***Mulefat***	***Coast live oak***	***Black willow***	***Red willow***	***Arroyo willow***	**Transect Total**
1	87					87
2	9					9
3			1			1
4	84					84
5	527	1				528
6	303		7			310
7	110			1	3	114
8						
9						
10	10		3			13
11	41		1		0	42
Species Total	**1,171**	**1**	**12**	**1**	**3**	**1,188**

4.3.4 Avifauna

Detailed avifauna survey results are provided in *Biological Survey Report for the Santa Maria Creek Restoration Project: riparian birds* (Lovio 2007, Appendix D) and are summarized here.

Several sensitive species were detected in riparian habitats in the Preserve, including:

Loggerhead shrike (*Lanius ludovicianus*); CSC, County Group 1
Southwestern willow flycatcher (*Empidonax traillii estimus*)*; FE, SE, County Group 1
Western bluebird (*Sialia mexicana*); County Group 2
Yellow warbler (*Dendroica petechia*); CSC, County Group 2

(FE = Federal Endangered, SE = Caifornia Endangered, CSC = California Species of Concern, County Group 1 = animals threatened or endangered or with specific natural history requirements, County Group 2 = animals becoming less common, but not yet so rare that extirpation or extinction is imminent without immediate action)

* Note: A single, singing willow flycatcher was detected in the Preserve on a single date in June, but did not establish a breeding territory and was considered to be migrating through the Preserve. However, this species is considered to potentially occur in the Preserve.

Bird species most commonly breeding within the Santa Maria Creek corridor are primarily habitat generalists, and include red-tailed hawk, American kestrel, mourning dove (Zenaida macroura), Anna's hummingbird (*Calypte anna*), black phoebe (*Sayornis nigricans*), ash-throated flycatcher (*Myiarchus cinerascens*), Cassin's kingbird (Tyrannus vociferans), western kingbird (Tyrannus verticalis), western scrub-jay (*Aphelocoma californica*), American crow (*Corvus brachyrhynchos*), bushtit (*Psaltriparus minimus*), spotted towhee (*Pipilo maculatus*), California towhee (*Pipilo crissalis*), brown-headed cowbird (*Molothrus ater*), blue grosbeak (*Guiraca caerulea*), and house finch (*Carpodacus mexicanus*). Only one species detected in 2005, the yellow warbler (*Dendroica petechia*), may be regarded as a riparian obligate species.

However, this species can show affinity for nonnative forests, and was associated with the eucalyptus woodland adjacent to the creek (Lovio 2006). In addition, several species, including sora (*Porzana carolina*), Virginia rail (*Rallus limicola*), and red-winged blackbird (*Agelaius phoeniceus*), were associated with the mulefat scrub and marsh habitats in the westernmost reach of the creek corridor.

4.3.5 Arroyo toad

Detailed arroyo toad survey results are provided in *Biological Survey Report for the Ramona Grasslands Preserve* (RECON 2005, Appendix C) and *Biological Survey/Monitoring Report for the Santa Maria Creek Restoration Project: arroyo toads* (Hollingsworth et al. 2006, Appendix E) and are summarized here.

A breeding population of arroyo toad has been documented in the Preserve, but only in the western reach of Santa Maria Creek, downstream of Rangeland Road (Figure 22). Arroyo toads were detected in this reach in both 2005 and 2006 (RECON 2005 and Hollingsworth 2006, Appendices C and E), but their abundance was considered to be less than is typical for similar stream systems (Hollingsworth et al. 2006, Appendix E). Western toad, two-striped garter snake, California kingsnake (*Lampropeltis getula*), and Pacific treefrog were also detected in this stream reach. A number of nonnative species including crayfish (*Procambarus clarkii*), mosquitofish (*Gambusia affinis*), largemouth bass (*Micropterus salmoides*), green sunfish (*Lepomis cyanellus*), and bullfrog (*Rana catesbeiana*) are present in the reach of the creek occupied by arroyo toads. The abundance of bullfrogs was considered quite high (Hollingsworth et al. 2006, Appendix E).

4.4 Invasive Nonnative Plant Removal

Detailed results of ongoing invasive nonnative plant control efforts are provided in *Biological Survey Report for the Ramona Grasslands Preserve* (RECON 2005, Appendix C) and *Invasive Weed Report for the Santa Maria Creek Restoration Project: grassland and riparian invasive weed control efforts and results* (Kelly & Associates 2007, Appendix F), and are summarized below.

The locations of invasive nonnative plants within the Preserve are shown in Figure 23a-c. Of particular concern were artichoke thistle (*Cynara cardunculus*), salt cedar (*Tamarix ramosissima*), and giant reed (*Arundo donax*). Additional invasive nonnative plants detected during the removal efforts in 2005 and 2006, include milk thistle (*Silybum marianum*), Italian thistle (*Carduus pycnocephgalus*), intermediate wheatgrass (*Elytrigia intermedia*), perennial pepperweed (*Lepidium latifolium*), and minor amounts of other nonnative species (Figure 23a, b). The majority of these invasive nonnative plants have been treated in 2005 and 2006 (Figure 24), and additional treatment will occur at least into the winter of 2007.

5.0 DISCUSSION

Preserve-wide

The approximately 2,000-acre Ramona Grasslands Preserve supports a wide diversity of plant and animals species, including a number of rare, threatened, or endangered species (Attachments B and C). The Preserve provides regionally significant grassland habitat for animal species such as SKR, ferruginous hawk, and golden eagle, and native plant species such as purple needlegrass, San Diego thornmint, small-flowered morning glory, and round-leaved filaree. San Diego fairy shrimp and spadefoot toad are well-distributed in ephemeral aquatic habitats (i.e., vernal pools, vernal swales, and alkali playas) in the Preserve. Santa Maria Creek supports a population of arroyo toad and both marsh and riparian associated bird species. Unique alkali playas are present in the Preserve, which provide habitat for rare plants species such as Parish's brittlescale and Coulter's saltbush.

Grasslands

The distribution of sensitive grassland species in the Preserve appears to be related to the structure and composition of grassland habitats, which a function of soil composition, topography, and grazing pressure. For example, SKR habitat is largely located within the central and northern portions of the Preserve (Figure 6), which are characterized by well-drained, loamy soil types (Figure 3) and heavy cattle grazing. Grassland habitats in these areas tend to have higher amounts of bare ground and greater ratios of forb species to grass species (Spencer and Montgomery 2007, Appendix A). These areas are also prime raptor foraging habitat, as the greater amount of bare ground and forb cover provide a habitat structure more conducive to detecting and catching prey species, primarily small mammals. The abundance of SKR is also sensitive to plant biomass, with areas of higher biomass or RDM exhibiting lower densities of SKR (Figure 9a, Appendix A). SKR abundance within a given year is dynamic in response to fluctuations in grassland structure, and the distribution of SKR shrinks back to the highest quality habitat areas in years of higher rainfall and increased vegetative growth.

Grasslands on clayey soil types, often located around the margins of the Preserve and presumably receiving less grazing pressure, are not good habitat for SKR. These clayey grassland habitats support the majority of the rare native plant species in the Preserve, and exhibit higher plant cover, less bare ground, and greater RDM than do areas supporting high densities of SKR. Thus, distinguishing between loamy and clayey grassland habitats appears to be useful means of identifying management targets and desired conditions for the grasslands in the Preserve. In addition, SKR habitat quality can be characterized by metrics of grassland structure. For example, high quality SKR habitat was characterized by mean RDM of 1,800 lbs/acre, and Spencer and Montgomery (2007, Appendix A) suggest that RDM of less than 3,000 lbs/acres may be a threshold for suitable SKR habitat. In addition, positive correlations between spring grassland biomass and fall and winter RDM were observed in this study (Figure 9b); thus, spring biomass measurements may provide land managers with early information to adjust grazing intensity to achieve management objectives.

The Preserve provides important habitat for wintering and breeding raptors. Ferruginous hawks are regular visitors to the Preserve, with between four to eight individuals regularly observed from 2003-2006; although WRI estimated as many as 22 ferruginous hawks were using the preserve in 2005 (WRI 2007, Appendix B). A pair of golden eagles regularly forages in the Preserve, and presumably these are the eagles nesting in nearby Bandy Canyon. Red-shouldered hawks were the most frequent breeders in the Preserve, and they and other species make use of the native and nonnative trees in the Preserve for nesting. Burrowing owls were reintroduced into the Preserve by WRI in 2005 and successfully breed in artificial nest boxes that year (WRI 2007, Appendix B). The average number of burrowing owls observed in 2006 was significantly greater than in previous years, indicating that the reintroduced birds and their offspring are likely over-wintering in the Preserve.

Vernal pools, vernal swales, and alkali playas

The various classes of ephemeral aquatic habitats in the Preserve exhibit unique biological structures and functions. For example, the Cagney swale supported the highest number of plant species but at least a dozen native plant species occurred in the Airport vernal pool complex that were detected in no other ephemeral aquatic habitats in the Preserve. The center and intermediate zones of the Airport pools, which support the majority of the native vernal pool flora, also had the greatest total plant cover and thatch cover (Figure 12). The alkali playas in the Preserve were the only habitat supporting Parish’s brittlescale and Coulter’s saltbush, and are also distinctive from other ephemeral aquatic habitats in their species composition and water chemistry. The hydrology of the various classes of ephemeral aquatic habitats also varied substantially, with pools associated with swales exhibiting much longer periods of inundation than the mima mound vernal pools in the Airport complex (Figure 13).

San Diego fairy shrimp and western spadefoot toads were well-distributed in the ephemeral aquatic habitats in the Preserve. Interestingly, San Diego fairy shrimp were only observed for a short period of time at the beginning of the survey period in 2005. Since vernal pool monitoring in 2005 started after significant fall season rains in 2004, it is unknown when San Diego fairy shrimp first emerged in vernal pools in the Preserve. Fairy shrimp were detected in all types of ephemeral aquatic habitats in the Preserve; although it is unknown whether fairy shrimp were transported into the single alkali playa monitored during 2005 by overland flow in the extremely wet winter that year or naturally occur in alkali playas. In contrast, western spadefoot toad was not detected in alkali playas, but Pacific treefrog and western toad were.

Santa Maria Creek corridor

Water quality data collected in 2005 and 2006 suggest that runoff from upstream urban and agricultural areas may be a non-point source of some pollutants in Santa Maria Creek. For example, conductivity, TDS, TN, total coliform bacteria, and chloride all exhibited their highest levels at SMC1, the most upstream monitoring station. The baseline water quality monitoring also showed that the concentrations of a number of water quality parameters, including TN, P, and total coliform bacteria, are correlated with stream flow, indicating that they may be transported into the system from upstream areas. The concentration of TSS is also correlated with stream flow but is lowest at the central sampling station, which is located in the most vegetated portion of Santa Maria Creek within the project area. This result tends to support the restoration project’s objective of improving water quality by restoring riparian vegetation and riverine functions. It is anticipated that improvements in water quality in Santa Maria Creek will be realized once future land management actions are implemented, and that the water quality monitoring program and baseline data presented here will provide a means for assessing these improvements.

Riparian vegetation in the Preserve is severely degraded by years of cattle grazing. Currently, there is virtually no tree cover and little shrub cover in the majority of reaches of Santa Maria Creek (Figure 21a). Only in the reach traversing the private properties along Vorhees Lane, where cattle have been excluded since the 1970s (CBI 2006), has a riparian woodland structure established. The cottonwood-willow riparian woodland in this reach is considered to be the model of what riparian habitat in Santa maria Creek upstream of Rangeland Road should look like in the future following elimination of cattle from the creek corridor. As of the end of 2006, almost the entire Santa Maria Creek corridor has been fenced to exclude cattle. Seedling riparian shrub and tree species, principally the understory shrub mulefat but also overstory willow species, were observed within transects surveyed for this report. Presumably seedling survival rate and vegetative cover will increase in the future. In addition, the Santa Maria Creek corridor in the western end of the Preserve supports perennial surface water and marsh plant communities that are distinct from the willow and mulefat dominated plant communities in the upstream reaches of the Creek exhibiting ephemeral surface water flow.

Riparian birds currently using the Preserve are dominated by generalist species. Only a single obligate riparian species was observed (yellow warbler), which was found nesting in nonnative forest adjacent to the creek. Enhancement of habitats in the Preserve for riparian obligate bird species will likely not result in the loss of habitat generalists from the avian community, but rather in an increase in bird species diversity by the addition of obligate riparian species. In addition, a distinct avifauna associated with the marsh habitats in the Santa Maria Creek corridor downstream of Rangeland Road was documented (Lovio 2007, Appendix D). The habitat for these marsh-associated species, which include sora, Virginia rail, and red-winged black bird, should be considered a management target distinct from the willow and mulefat dominated habitats and their associated riparian avifauna that occur upstream of Rangeland Road

Arroyo toad habitat in the Preserve appears to be restricted to the reach of Santa Maria Creek downstream of Rangeland Road, and is driven by surface water hydrology. The creek channel in the upstream portion of the Preserve is predominately sandy alluvium and is characterized by an ephemeral stream flow. In the reaches upstream of Rangeland Road, Santa Maria Creek flows only in response to rainfall events. Even in the very wet winter of 2005, surface flow had stopped by June. However, at the extreme western end of the Preserve, surface water appears to be perennial. CBI (2006) speculated that the granitic geology forming the western “wall” of the Santa Maria Valley, through which the creek has cut Bandy Canyon, may maintain groundwater at a shallower depth below the channel bottom than in the eastern end of the Valley by “impounding” shallow groundwater as it flows through the Valley to Bandy Canyon. This would also explain the presence of marsh vegetation in this reach of the creek, which requires consistently high groundwater. Regardless of the mechanism, which clearly requires more investigation, it appears that the western end of the Preserve consistently provides suitable habitat for arroyo toads, whereas the eastern end of the Preserve typically does not provide suitable habitat for this species. In addition, Hollingsworth et al. noted a very high abundance of bullfrogs and other nonnative aquatic species in the arroyo toad habitat in the Preserve and observed that arroyo toad abundance was less than is typical for similar stream systems occupied by this species (Hollingsworth et al. 2006, Appendix E). The Ramona Water District operates effluent holding ponds in close proximity to arroyo toad habitat in Santa Maria Creek that could be a source of bullfrogs. Nonnative predators in Santa Maria Creek, such as bullfrogs, may be adversely affecting the abundance of arroyo toads in this system.

Invasive nonnative plants

Invasive nonnative plants, particularly artichoke thistle, continue to be a problem in the Preserve. Invasive nonnative plants have been the subject of eradication efforts since 2005, and as of the writing of this report, artichoke thistle continues to germinate in significant numbers. Ongoing monitoring and control of invasive nonnative plants will be required for at least several years to adequately control these species. In addition, adjacent properties outside of the Preserve continue to serve as sources of invasive nonnative plants, and every effort should be made to expand weed abatement efforts to these areas.

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